via e-mail

February 11, 2016
FPU16-167

Ms. Catherine Jerrard
AFCEC/CIBW
706 Hangar Road
Rome, NY 13441

RE: WAFB – ADEQ Comments – ST012, - *Draft Addendum #2 Remedial Design and Remedial Action Work Plan for Operable Unit 2 [OU2] Revised Groundwater [GW] Remedy, Site ST012, Former Williams Air Force Base, Mesa, Arizona*; prepared for Air Force Civil Engineer Center AFCEC/CIBW, Lackland AFB, Texas; prepared by Amec Foster Wheeler Environment & Infrastructure, Phoenix, Arizona; document dated November 30, 2015

Dear Ms. Jerrard:

Arizona Department of Environmental Quality (ADEQ) Federal Projects Unit (FPU) and ADEQ contractors UXO Pro, Inc. and Praxis Environmental reviewed the referenced document. General and Specific Comments are provided below.

General Comments

1. ADEQ recommends that additional microbial analyses be performed at various site locations to determine if non-sulfate-reducing bacteria play a significant role in the degradation of site constituents. It is currently unknown if sulfate-reducers are the dominant hydrocarbon-degrading species in the system.

2. Groundwater geochemistry results for the entire site should be reviewed to determine if a different terminal-electron acceptor dominates at other site locations. This will help discern if populations other than sulfate-reducers are strongly active at the site and significantly impacting the polishing of site constituents.

3. The plan assumes that site microbial populations will rebound after steam treatment. This population rebound should be confirmed and monitored to ensure that this polishing step progresses as planned and that the degrading microbial population is (and remains) strong enough to achieve the remedial goal. ADEQ recommends stable isotope probe (SIP) analysis to specifically monitor the degrading population, providing information about population size, health, in-situ target compound biodegradation rates, and possible environmental stressors. It will also definitively prove in-situ target compound bioattenuation.

4. Modflow-Surfact is a subsurface fate and transport modeling software, but is not necessarily a bioremediation modeling software package. How are the actions of bioattenuation being modeled? Has Modflow-Surfact been demonstrated successfully elsewhere to model bioremediation?

5. The reduction in LNAPL volume for treatment by EBR (presented in Section 2.1 and summarized in Table 2-1) is not sufficiently justified. The reduction is based on calculations presented in Appendix A that include an assumed uncertainty factor. The uncertainty factor is applied "*to account for LNAPL distribution being through lenses and stringers rather than continuous throughout the zone*" and provides a lower range estimate of volumes. However, as acknowledged in Section 2.1, the estimate assumes only residual LNAPL exists even though mobile LNAPL has been observed. Hence, assuming an uncertainty factor that increases the LNAPL volume estimate to account for accumulations exceeding residual saturation is just as valid.

6. Through 10 October 2015 the BTEX+N remained at elevated concentrations in the extracted water indicating limited depletion of LNAPL sources within the TTZ and suggesting either a larger volume of LNAPL in the TTZ than originally assumed or a lower extraction efficiency by SEE than assumed (e.g., limited contact between flowing steam and residual LNAPL). As a result, the depletion of COCs from residual LNAPL remaining after SEE may be less than expected and not approach the reduction of 90% assumed in Section 2.3 for the TTZ. As a result, the sulfate estimates may be low.

7. The groundwater modeling and particle tracking in the Work Plan are difficult to follow and evaluate. The relationship between the modeling and the sulfate distribution and utilization is not evident. A suggested approach is to model the injection of a tracer with a simple first order reaction rate to represent sulfate. The distribution and utilization over time would allow various reaction rates to be evaluated (representing combinations of COC dissolution rate and sulfate utilization rate). Limitations posed by the mass transfer of COCs from residual LNAPL and COC diffusion into zones with dissolved sulfate are not considered in the injection and dosing calculations. Rebound and repeated sulfate injections should be expected.

8. The characterization of the LNAPL outside the TTZ has numerous gaps, especially in the LSZ to the southeast of Sossaman Road. Extraction should be considered in this area and can be based on observations during the installation of wells LSZ45 and LSZ46 (see Figure 2-6).

9. According to the most recent analytical data, Benzene concentrations persist above the AWQS in perimeter wells W34 and W36. Additional down gradient monitoring wells are required to characterize the full lateral extent of contamination in this area.

Specific Comments

1. Section 2.2 should include a discussion of BTEX+N concentrations in extracted water. Through 10 October 2015 these compounds remained at elevated concentrations in the extracted water indicating limited depletion of sources within the TTZ and suggesting a larger volume of LNAPL in the TTZ than originally assumed.

2. Page 2-1, lines 355 and 370. Well locations with LNAPL are of interest for TEA injections rather than extraction. Wells with LNAPL present or suspected in the vicinity should be candidates for extraction rather than injection to enhance the LNAPL recovery described in Section 2.1, Lines #256-259.

3. Page 2-2, Table 2-5. The LNAPL composition data provided in Table 2-5 does not indicate any reduction in aromatic or naphthenic compounds in the LNAPL between January and June 2015 and therefore no preferential depletion of these compounds from the LNAPL. Does additional LNAPL composition data exist indicating a depletion of these compounds?

4. Page 2-2, lines 452-455 state, "To account for a reduction in the volatile content of the remaining LNAPL due to the increased temperatures in the zones, further reductions in BTEX+N mass were applied in both the TTZ (90%) and TIZ (25%) to estimate the quantity of BTEX+N LNAPL remaining after SEE treatment." Please provide justification for these reduction values. As stated in the General Comments and above, through 10 October 2015 the BTEX+N remained at elevated concentrations in the extracted water indicating limited depletion from residual LNAPL within the TTZ.

5. Please provide example calculations for the numerical values presented in Table 2-6.

6. Page 2-3, line 470 states "it is possible that pre-SEE volume estimates were overestimated," however it is just as likely that the volume estimates were underestimated based on the persistence of BTEX+N concentrations in extracted water and the persistence of LNAPL recovery. The mass recovery figures in the weekly SEE operations reporting do not show a decline in recovery. Therefore, Table 2-6 values should not be used as an upper bound as indicated in Line #492.

7. Page 2-4, line 495. Please edit to read, "revised pre-SEE total residual volume" rather than "correct".

8. Page 2-4, line 498. Change the volume estimate from 987,000 to 87,000.

9. Page 2-4, line 500-501. 18-25,000 lbs BTEX+N remains in the in LPZ. How will this be addressed?

10. Page 2-5, line 517. Please summarize the basis for the following statement: "The data collected for sulfate degradation from the EBR Field Test indicated that the density of sulfate degrading bacterial populations were higher and that dispersivity values and sulfate utilization rates were more favorable than assumed in RD/RAWP EBR modeling."

11. Page 3-3, line 668. Data from SEE operations are inconclusive on LNAPL reduction. The following statement, "As shown in Tables 2-6 and 2-7, the bulk of the remaining BTEX+N on site is located outside of the TTZ" should be revised to read, "is assumed to be located outside of the TTZ."

12. Page 3-4, line #686. Revise to read Figures E-1 through E-3.

13. Page 3-4, line #687. Please provide a more detailed presentation of travel time from each injection well to extraction well in Appendix E. The travel time should be compared with the utilization rate, ambient groundwater travel times, and residual LNAPL dissolution rates. Flooding the subsurface with sulfate runs the risk of ambient flow sweeping it downgradient before COCs dissolve out of residual LNAPL and react with the sulfate found predominantly in more permeable soils.

14. Section 3.3. Dosing should also consider the dissolution rate of COCs from residual LNAPL, as described in the above comment. The TEA utilization rates may ultimately be limited by the rate of COC dissolution from LNAPL and the mingling of sulfate with the dissolved COCs. Rebound, also known as back-diffusion, should be expected at the end of the EBR and accounted for in the MNA calculations.

15. Page 4-4, line 870. Wells W11 and W37 are included in the list of wells to be re-developed and converted to TEA injection wells. However, on January 8, 2016 well W11 contained nearly 5 ft. of LNAPL, and well W37 contained over 75 ft. of LNAPL. Please provide the rationale for injecting TEA into wells having significant LNAPL.

Closure

ADEQ may add or amend comments if evidence to the contrary of our understanding is discovered; if received information is determined to be inaccurate; if any condition was unknown to ADEQ at the time this document was signed; or if complementary regulatory agencies bring valid and proven concerns to our attention.

Thank you for the opportunity to comment. Should you have any questions regarding this correspondence, please contact me by phone at (602) 771-4121 or e-mail miller.wayne@azdeq.gov.

Sincerely,

Wayne Miller
ADEQ Project Manager, Federal Projects Unit
Remedial Projects Section, Waste Programs Division

cc:	Catherine Jerrard, USAF AFCEC/CIBW	catherine.jerrard@us.af.mil
	Carolyn d'Almeida, U.S. EPA	dAlmeida.Carolyn@epamail.epa.gov
	Terie Glaspey, AFCEC/CIBW	terie.glaspey@us.af.mil
	Steve Willis, UXO Pro, Inc.	steve@uxopro.com
	ADEQ Reading and Project File	